CLAIMS

1. An electro-optic modulation device that includes electro-optic crystal (1) having a birefringence index changed by a coupled electric field, and one pair of electrodes (5a, 5b) disposed so as to have the electro-optic crystal interposed therebetween to couple the electric field to the electro-optic crystal, and that changes polarization of light incident between the one pair of electrodes according to a change of the birefringence index depending upon a strength of electric field coupled via the one pair of electrodes, wherein

the electro-optic crystal (1) comprises grooves (3a, 3b) parallel to a direction of the incident light respectively on one pair of side faces parallel to the direction, and consequently a thin crystal portion sandwiched between the grooves serves as a portion for coupling the electric field, and

the one pair of electrodes (5a, 5b) are formed so as to fill the grooves (3a, 3b), respectively.

2. The electro-optic modulation device according to claim 1, wherein the grooves (3a, 3b) are formed on the one pair of side faces so as to range from one to the other of end faces (1c, 1d) through which light is incident or emitted.

3. The electro-optic modulation device according to claim 1, wherein the grooves are formed in only a central portion except end portions between the end faces through which light is incident or emitted, in the one pair of side faces.

4. An electro-optic modulation device that includes electro-optic crystal (1) having a birefringence index changed by a coupled electric field, and one pair of electrodes (7a, 7b; 7aa, 7bb) disposed so as to have the electro-optic crystal interposed therebetween to couple the electric field to the electro-optic crystal, and that changes polarization of light incident between the one pair of electrodes according to a change of the birefringence index depending upon a strength of electric field coupled via the one pair of electrodes, wherein

the electro-optic crystal (1) comprises grooves (3a, 3b; 4a, 4b) parallel to a direction of the incident light respectively on one pair of side faces parallel to the direction, and consequently a thin crystal portion sandwiched between the grooves serves as a portion for coupling the electric field,

the one pair of electrodes (7a, 7b; 7aa, 7bb) are formed in bottom portions of the grooves (3a, 3b; 4a, 4b) so as to have a predetermined thickness, and

at least remaining portions of the grooves (3a, 3b; 4a, 4b) except the one pair of electrode portions

are filled with insulators (9a, 9b; 9aa, 9ba; 10; 10a, 10b).

5. The electro-optic modulation device according to claim 4, wherein the grooves (3a, 3b) are formed on the one pair of side faces so as to range from one to the other of end faces (1c, 1d) through which light is incident or emitted.

6. The electro-optic modulation device according to claim 4, wherein the grooves (4a, 4b) are formed in only a central portion except end portions between the end faces (1c, 1d) through which light is incident or emitted, in the one pair of side faces.

7. The electro-optic modulation device according to any one of claims 4 to 6, wherein

remaining portions of the grooves (3a, 3b; 4a, 4b) except the one pair of electrode portions (7a, 7b; 7aa, 7bb) are filled with insulators (10), and

a whole of portions except the end faces through which light is incident or emitted is covered by further insulators (10).

8. The electro-optic modulation device according to any one of claims 4 to 7, wherein the insulators (9a, 9b; 9aa, 9ba; 10; 10a, 10b) are wax.

9. An electro-optic modulation device that includes electro-optic crystal (1; 61; 61A) having a birefringence index changed by a coupled electric field, and one pair of electrodes (25a, 25b; 29a, 29b; 64a, 64b) disposed so as to have the electro-optic crystal interposed therebetween to couple the electric field to the electro-optic crystal, and that changes polarization of light incident between the one pair of electrodes according to a change of the birefringence index depending upon a strength of electric field coupled via the one pair of electrodes, the electro-optic modulation device comprising:

a base portion (63); and

a ridge-shaped ridge portion (21; 21a; 64) projected on one side face of the base portion (63) and extended in a direction of the incident light, at least a part of the ridge portion comprising the electro-optic crystal, the ridge portion having a width equivalent to a predetermined value or less,

wherein the one pair of electrodes (25a, 25b; 29a, 29b; 64a, 64b) are formed on one pair of side faces opposed in a width direction of the ridge portion (21; 21a; 64).

10. The electro-optic modulation device according to claim 9, wherein the ridge portion (21; 64) is formed nearly in the center on the one side face of the base portion when seen from the direction of the light incidence.

11. The electro-optic modulation device according to claim 9, wherein the ridge portion (21a) is formed on an end on the one side face of the base portion when seen from the direction of the light incidence.

12. The electro-optic modulation device according to claim 9, further comprising an insulator (10) which covers the whole.

13. The electro-optic modulation device according to claim 9, further comprising an insulator (10) which covers the ridge portion (21; 21a; 64).

14. The electro-optic modulation device according to claim 9, further comprising an insulator (10) which covers a top surface of the ridge portion (21; 21a; 64) and side faces of the one pair of electrodes (25a, 25b; 29a, 29b; 64a, 64b) forming faces continuous to the top surface.

15. The electro-optic modulation device according to any one of claims 12 to 14, wherein the insulator (10) comprises wax.

16. The electro-optic modulation device according to claim 9, comprising a low refractive index medium (62) having a refractive index which is lower than a refractive

index of the electro-optic crystal, at least near a side face of the ridge portion (64) located on the base side and included in one pair of side faces other than the one pair of side faces on which the one pair of electrodes (64a, 64b) are formed.

17. The electro-optic modulation device according to claim 16, wherein the ridge portion (64) comprises the electro-optic crystal (61), and the base portion (63) comprises the low refractive index medium (62).

18. The electro-optic modulation device according to claim 16, wherein the ridge portion (64) and an upper part of the base portion (63) comprise the electro-optic crystal (61), and a remaining lower part of the base portion (63) comprises the low refractive index medium (62).

19. The electro-optic modulation device according to claim 16, wherein the base portion (63) and a lower part of the ridge portion (64) comprise the low refractive index medium (62), and a remaining upper part of the ridge portion (64) comprises the electro-optic crystal (61).

20. The electro-optic modulation device according to any one of claims 17 to 19, wherein the low refractive index medium (62) is electro-optic crystal which

comprises chemical elements of the same kinds as those of the electro-optic crystal (61), but which is lower in refractive index on the basis of a difference in composition ratio.

21. The electro-optic modulation device according to claim 16, wherein the ridge portion (64) comprises the electro-optic crystal (61), an upper part of the base portion (63) comprises an adhesive agent (62a), and a remaining lower part of the base portion (63) comprises a substrate (66).

22. The electro-optic modulation device according to claim 16, wherein the ridge portion (64) and an upper part of the base portion (63) comprise the electro-optic crystal (61), a lower part of the electro-optic crystal of the base portion (63) comprises an adhesive agent (62a), and a remaining lower part of the base portion (63) comprises a substrate (66).

23. The electro-optic modulation device according to claim 16, wherein the base portion (63) comprises a substrate (66), a lower part of the ridge portion (64) comprises an adhesive agent (62a), and a remaining upper part of the ridge portion (64) comprises the electro-optic crystal (61).

24. The electro-optic modulation device according to

claim 16, wherein the low refractive index medium (62) comprises gas or a vacuum state in a cavity (81a, 89) provided in an upper part of the base portion (63).

25. The electro-optic modulation device according to claim 9, wherein the ridge portion (64) comprises the electro-optic crystal (73a), and the base portion (63) comprises photonic crystal (75) having a periodic structure.

26. An electro-optic modulation device that includes electro-optic crystal (31) having a birefringence index changed by a coupled electric field, and one pair of electrodes (33, 35) disposed so as to have the electro-optic crystal interposed therebetween to couple the electric field to the electro-optic crystal, and that changes polarization of light incident between the one pair of electrodes according to a change of the birefringence index depending upon a strength of electric field coupled via the one pair of electrodes, the electro-optic modulation device further comprising:

an insulator (37) applied so as to relatively fix the electro-optic crystal (31) and the one pair of electrodes (33, 35), except end faces through which light is incident or emitted.

27. The electro-optic modulation device according to claim 26, wherein the insulator (37) comprises a matter

that has viscosity and a property of becoming hard with the lapse of time.